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ABSTRACT

New technologies used by libraries include computers, minicomputers, photocopiers, audiovisual equipment, videocable, and satellite. Cataloging is a major area of computer application, with the MARC (MAchine Readable Cataloging) format developed by the Library of Congress providing batch mode services, and the more sophisticated OCLC (Ohio College Library Center) bibliographic data base providing online retrieval and entry of information for cataloging monographs. The success of OCLC has encouraged establishment of regional library networks, as well as several other online systems, and control of serials and periodicals via computer is now in experimental stages through the CONSER (CONversion of SERials) project. Minicomputers have been readily adapted to library circulation systems and are widely accepted in public libraries. Online information retrieval, which was initially a tool for special libraries, is beginning to be offered by public and academic libraries, although the expense of such systems usually demand part or full recovery of search costs from the patron and the controversy of fee-for-service vs. no-charge has yet to be resolved. Continuing education for librarians and education for library patrons are important for the acceptance of future developments in library technology. (Author/JAB)

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TECHNOLOGY IN LIBRARIES: 1960-2000

by

Susan K. Martin

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Introduction

Libraries have traditionally been underfunded in terms of accomplishing the goals and services which they have set for themselves and for their clientele. Perhaps this fact accounts for the increasing adoption of computer and other new technologies by librarians who are eager to find ways to bring costs down while retaining or improving the level of services. Microforms and punched card equipment have been in use in some libraries since the first decades of this century; in the late 1950's and early 1960's it became apparent that bibliographic data and the file-handling functions performed by libraries were ideal applications for the emerging computer technology.

In the first years of automation, much effort was devoted to "information storage and retrieval." With Vannevar Bush's dream in mind, information specialists worked with the premise that if all information is accessible by computer, anyone who needs information should be able to retrieve it easily by merely giving the computer a few simple instructions. The desired effect would be achieved: to serve users better and faster. Unfortunately, the statement of the solution is considerably easier than its achievement. In the 1960's, computer technology could not economically provide storage for vast files of bibliographic data. Libraries were not organizationally prepared to act as the intermediaries between the computer and the patron. Therefore, the first major steps in library technology were applications relating to the "back room" or housekeeping functions--cataloging, acquisitions, and circulation. Only in the 1970's have the library profession and its commercial suppliers gained sufficient expertise to move technology directly into the public service functions.

The Technology

Among the new technologies used by libraries are computers, minicomputers,

photocopiers, audio-visual equipment, videocable, and satellite.

Before 1970, most of the computer applications were in "batch mode;" that is, punched cards or punched paper tape representing bibliographic records were prepared by the library and sent on a daily, weekly, or less frequent basis to a separate computer center. Following a pre-arranged schedule, the computer center then "ran the job" and produced a computer print-out (and perhaps other by-products) to be send back to the library. In a cataloging application, the computer print-out could take the form of 3 x 5 cards to be filed in the catalog. The library then began accumulating data again for the next run.

Around 1970, batch systems began to be replaced with "on-line" systems. In such systems, the keyboard operator uses a typewriter terminal which is connected directly to the computer. Data can be input to the master file directly; the keyboarder can request that the computer respond with specific information in order to make decisions. For example, a catalog file may be on-line; the keyboarder can request that all records with an author's name of "John E. Smith" be displayed. The keyboarder, who is presumably cataloging a book by John E. Smith, may use existing data rather than waiting for the results of the daily or weekly run.

On-line systems tend to be considerably more expensive than batch systems. However, they allow economy in the work flow operation. As we will see later, on-line minicomputer systems form the basis for several recently developed library systems.

The Catalog

As the backbone of every library collection, the catalog and its bibliographic displays have received more attention from library technologists than any other library function. Going back to Melville Dewey's

desire to catalog each book only once, librarians worked to standardize the format of bibliographic data, so that one library's data could be used by another. When the data are intended for computer manipulation, this standardization must take the form of explicit identification of parts of the catalog which had previously been recognized only implicitly (such as coding the language, the type of material, etc.), and of precise formatting of the content of the bibliographic record itself.

In the mid-1960's, work began on a standard format for machine-readable bibliographic data. The MAchine Readable Cataloging (MARC) format, developed at the Library of Congress, was tested for a year, modified on the basis of this testing, and the development of the MARC II format was complete by 1968. In 1969, the Library of Congress began to distribute cataloging data for English-language books in the MARC format, using computer magnetic tape. Since then, the scope of this distribution service has expanded to include all roman-alphabet books cataloged by the Library of Congress, and cataloging for other types of materials, such as maps, music, serials, and audio-visual materials.

The first subscribers to the MARC tapes were libraries which had developed, or were developing, computer-based systems to support their cataloging operations. Among these were the New York Public Library, the University of Chicago, and Stanford University. Other customers included vendors of bibliographic data, who were able to use the MARC tapes to provide standard cataloging to their customers.

The MARC distribution service is a batch system. Subscribers to the service receive tapes on a weekly basis and use them to update their own files of machine-readable bibliographic data.

Networks for Cataloging

With the advent of more sophisticated technology, the Ohio College Library Center (OCLC) began an on-line service in 1971 that revolutionized library automation--and the revolution continues. OCLC offered to its members and then to libraries outside Ohio the capability of communicating with OCLC's large bibliographic data base by means of a computer terminal and data-transmitting telephone lines. A library could search the data base for a specific cataloging record; if found, the library could "order" a set of catalog cards by pushing a button. If the requested record was not found, the library could choose to "input" (key on the terminal keyboard) all the appropriate bibliographic data. Again, the resultant product was a set of catalog cards. In addition, the OCLC system adds the abbreviated name of the library to each record for which catalog cards are ordered. Libraries not owning particular books but wishing to borrow them on inter-library loan can look at the record on their cathode ray tube (CRT) screens and identify those institutions which do own the item.

From an initial membership of fifty-five libraries and a small data base of about 200,000 records, OCLC has grown until in 1978 it serves nearly 1500 libraries throughout the country with a data base of over 3,000,000 records. Several other on-line systems have been developed, usually to serve one library at first and then expanded to serve groups of libraries. Among these are the Bibliographic Automation of Large Libraries using an On-line Timesharing System (BALLOTS) system at Stanford University; the University of Toronto Library Automation System (UTLAS); the Washington Library Network (WLN), and the University of Chicago and Northwestern University Libraries' systems.

Although libraries had been organized (unsystematically) into groups to facilitate sharing of materials and services, the success of OCLC's system encouraged the establishment of library networks designed in part to provide an interface between the individual library and OCLC. Examples of these networks are the New England Library Information Network (NELINET), the State University of New York (SUNY), the Amigos Bibliographic Council (in Texas), and th California Library Authority for Systems and Services (CLASS). In 1978, about two dozen organizations belong to the Council of Computerized Library Networks (CCLN). These organizations represent the approximately 2000 libraries which are engaged in or are about to engage in on-line library networking.

In 1976, the Library of Congress formed a Network Advisory Group (NAG), representing the various networks and types of libraries. By the middle of 1977, the NAG had issued a reported entitled, Toward a National Library and Information Service Network; this report is intended to focus the attention of the library community on those steps necessary to create a national bibliographic network. Among the topics addressed are network governance, bibliographic standards, and technological requirements.

To form a single bibliographic network for the nation (as the airlines have done with their reservations network, for example), existing and future computer systems will need to be able to communicate using standard techniques and codes. The MARC format is the standard record format; however, until recently, the library community had not established a standard for sending data from one computer to another. A computer protocol was needed to identify the source of the message, the destination, and the nature of the transaction (is it a request for bibliographic data? A response to a

previous request? A request for holdings information? etc.). A group composed of representatives of ALA's Information Science and Automation Division, the National Bureau of Standards, and the National Commission on Libraries and Information Science (NCLIS) has completed definition of a computer-to-computer communications protocol; in 1978 this protocol will begin its way through the procedures which lead to adoption as a national standard.

The New Catalog

Machine-readable bibliographic data allows a library considerable flexibility in the form of its catalog. Cards are possible, of course; OCLC and BALLOTS generate millions of catalog cards annually. However, more libraries are considering book catalogs, or their economically viable counterparts--the Computer Output Microform (COM) catalogs.

Throughout the country, public, academic, and special libraries with bibliographic data in machine-readable form are producing microfilm or microfiche catalogs for wide distribution of their entire catalog to all branches and public service points. Two firms--Information Design and Autographics--have developed microfilm readers especially for library catalog use. Book and microform catalogs will become increasingly prevalent as the cost tradeoffs become apparent.

Although less experience exists with on-line catalogs than with microform catalogs, a few libraries and companies have installed on-line terminals for patron use. Some disadvantages are obvious: the patron who cannot use a keyboard, or the cost of computer time. We have much to learn in the area of patron use of on-line catalogs; we must begin by educating our patrons to the rapidly changing bibliographic environment.

Serials

Control of periodicals and serials is difficult and time-consuming for most libraries. Years ago, many libraries represented serials information separately from the card catalog, in the form of a typed or printed serials list. With the promise of computer sophistication, librarians attempted to apply computerized techniques to serials check-in. As it turned out, this attempt was a grave mistake in the early and mid-1960's. The serials check-in function is more complex than had been realized, and professionals had not had sufficient experience with automation at that time. After a few embarrassing lessons, they turned their attention back to cataloging and circulation, leaving only the relatively simple task of listing serial or periodical titles by machine.

In 1973, a group of librarians requested and received support from the Council on Library Resources to build a data base of bibliographic records for serials so that each library would not have to convert all of its data to machine-readable form, duplicating the efforts of other libraries. The CONversion of SERials (CONSER) project began, using OCLC as the mechanism and the Minnesota Union List of Serials as the basic file. Each of fifteen participating libraries was given a segment of the alphabet to convert from its own serial records. It was anticipated that a full file of 300,000 serial records would be built in two years.

Four years after initiation of the project, about 150,000 titles have been input. Again, the difficulties of the project were significantly underestimated. CONSER is continuing, but with support from OCLC rather than from CLR , and with many doubts on the part of librarians as to the validity of the effort. As of early 1978, the Library of Congress

and OCLC were both planning to continue development of the CONSER data base.

Since the advent of its on-line catalog, OCLC had been promising another on-line function--serials check-in. Several years' delay attested to the difficulty of the task. In late 1976, after four years of waiting, 150 OCLC users began checking in serials on-line. Because of the burden placed on the computer facility, no additional libraries were allowed to use on-line check-in. Although librarians have called for development of on-line serials control, the only major successful on-line serials check-in system is that of the Biomedical Library at UCLA, which allows staff to process serials data on-line while providing patron access by means of computer print-outs.

Circulation

Because of its similarity with inventory control, circulation is the library function which requires the least effort to automate. The first mechanical system in the United States was a punched-card system developed at the University of Missouri-Columbia in the 1930's. Circulation systems range from the simple to the sophisticated, from a single call number per item to a full bibliographic record.

Throughout the 1960's, libraries designed their own circulation systems, based primarily on punched card and then computer technology. In the 1970's, minicomputers became available, and several companies began to develop on-line "turnkey" circulation systems--generalized systems which are designed to be installed and operated in a library whose staff may lack expertise in systems or computers. The first of these systems was Computer Library Systems Incorporated (CLSI), now installed in over 100 libraries throughout the country. Using the bar-coding schemes now prevalent in supermarkets, the systems allow input of book and borrower identification to create a circulation transaction. Varying loan periods, overdues,

holds, and recalls are functions of these systems. In the Chicago area, several large public library systems have interconnected CLSI systems, enabling intersystem querying and borrowing.

The step to minicomputer technology has not been without its difficulties. Four commercial circulation systems available in 1976 are no longer on the market; however, five companies are offering new (and sometimes untested) circulation systems to the library market.

Because of its characteristics, public library circulation appears to be easier to automate than academic library circulation. CLSI, which began as a public library system, continues its resounding success in this area, while its academic library customers are less delighted.

The interface between cataloging and circulation systems is one to be explored further in the coming years. The University of Chicago has made significant strides, with an on-line technical processing system which is linked to a minicomputer-based circulation system. For query or for patron notification, the circulation system is able to access the full bibliographic record.

Public Services

Information retrieval, long a dream of information scientists, became a reality for most disciplines in the early 1970's, when the Lockheed Information System and the System Development Corporation (SDC) began acting as distributors of on-line data bases. The publishers of specialized indexes, having used computerized photocomposition techniques, sought additional revenue by making the machine-readable data available through Lockheed and SDC; this approach followed closely the National Library of Medicine's move from paper to on-line retrieval in its MEDLINE system.

At the end of 1977, dozens of data bases were accessible on-line, in fields ranging from engineering to sociology and history. The prices of these costly services were driven down in 1976 by the appearance of a successful competitor to the two original distributors--the Bibliographic Retrieval Service (BRS).

Initially, on-line retrieval was a tool for special libraries, followed soon by academic libraries. By 1975, public libraries began to experiment with the use of the systems, some of them concentrating primarily on the services offered by the current-events-oriented New York Times Information Bank. Together with the expanded use of the systems came the question of fiscal support. Under normal circumstances, a library could not support on-line reference services within its budget. Academic libraries which tested this approach found that full or partial charging for direct costs caused a decrease in the demand for the service, but allowed them to continue to offer it to those willing and able to pay. Some public libraries followed suit. At the same time, many professionals began to decry the technique of charging for services, believing that all services should be free of charge in a publicly supported institution. The planning effort required to eliminate older, less valuable programs in favor of full support of on-line reference has not been forthcoming in most institutions. However, network organizations such as BRS in Colorado and CLASS in California have established "group" on-line reference services.

An area that is affected by both on-line reference services and automation of cataloging procedures is interlibrary lending and borrowing. With a network-based system, it is possible to query the file to determine which neighboring libraries own the desired book. OCLC is designing a feature

which will allow a requesting library to leave an "on-line message" for the owning library, thus obviating the need to use the postal service.

Other technologies affecting public service are the photocopier, audio-visual techniques, videocable, and satellites.

Photocopiers have revolutionized the information-transfer process, and at the same time have created consternation on the part of publishers and attorneys. The 1976 Copyright Law, taking effect on January 1, 1978, has not significantly diminished the amount of photocopying that is done both within and outside libraries in this country. The National Commission on New Technological Uses of Copyrighted Works (CONTU) must strive further to resolve the questions raised by developing technologies: how is it possible to protect the creator or proprietor of data, in an age when technology allows small portions of data to be copied and/or modified with little expense and with incredible ease?

Audio-visual technologies are solidly established in school and public libraries, in the form of sound recordings, films, tapes, film loops, and slides. Since 1975, librarians have created a section within the American Library Association to deal with both hardware (equipment) and software (material) concerns of audio-visual material. By mid-1978, the National Commission on Libraries and Information Science (NCLIS) will issue a report from its Project Mediabase--an effort to establish standards and bibliographic control for audio-visual material used in libraries.

Also a recent focus of a section within ALA, videocable technology promises much for the future. Those libraries which are able to establish videocable programs have sponsored a wide variety of events, from televised story hours, to community events, to on-demand televised reference service.

Satellite and microwave transmission are of concern in this area, as well as the federal regulations which govern the air waves.

Future Trends and Planning

The planning function becomes difficult where intermediate or long-range technologies are concerned. It is relatively easy to state the direction of today's trends; tomorrow's are more difficult, and the requirements of a library ten or twenty years from now are nearly impossible to gauge.

It is likely that minicomputers will be prevalent in the coming decades, although very large files will still be best handled by large computers. Microforms will be a useful interim device for bibliographic tools, but on-line processing will ultimately be more economical and efficient. A national bibliographic system will include the abstracting and indexing service data bases; it will be necessary to provide authority control in order to reconcile the data that are input by libraries with those that are input by abstracting and indexing services. Users who are now accustomed to card catalogs will need to be retrained to use microform and even on-line catalogs. Library staff members will become more skilled in assessing technological developments and in accepting new forms of data.

How do we plan for these important changes for the future? An important ingredient is the continuing education of each librarian. Equally important will be the efforts, on a statewide, regional, and national basis, to educate our patrons and our funding agencies to the highly dynamic nature of the library environment and the beneficial effects that can accrue to the community. Our governing agencies, unfortunately, still largely see librarians as those who check out books. Therefore, our planning must be aimed at informing them of the need for additional funding, additional technologies, and additional services, to give vital support to an increasingly information-dependent society.

Notes on Author

Susan K. Martin is nationally known in the library automation field. She was formerly on the staff of the Harvard University Library and is currently Head, Library Systems Office, University of California, Berkeley. Ms. Martin is also Editor of the Journal of Library Automation.